CLAIMS

1. A capacitor, comprising:

a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

a second electrode; and

a dielectric between said first and second electrodes.

2. The capacitor of claim 1, wherein the capacitor is selected from a group consisting of flat capacitors, crown capacitors, and post capacitors.

3. The capacitor of claim 1, wherein the transition metals are selected from a group consisting of Pt, Rh, Ir, Ru, and Pd.

4. The capacitor of claim 1, wherein the conductive metal-oxides are selected from a group consisting of IrO_x, RuO_x, and RhO_x and wherein $x < 4$.

5. The capacitor of claim 1, wherein said first electrode has a non-smooth surface.

6. The capacitor of claim 1, wherein the first electrode has a non-smooth surface and is selected from the group consisting of Pt, Rh, Ir, Ru, Pd, IrO_x, RuO_x, and RhO_x, wherein $x < 4$.

7. The capacitor of claim 1, wherein said second electrode is selected from a group consisting of transition metals, conductive metal-oxides, conductive metal nitrides, WN, aluminum, TiN, TaN, polysilicon, and combinations thereof.

8. The capacitor of claim 1, wherein said dielectric is formed from an insulating metal oxide.

9. The capacitor of claim 8, wherein the insulating metal oxide includes a material selected from the group consisting of barium strontium titanate, $SrTiO_3$, Ta_2O_5, $Sr_wBi_xTa_yO_z$, and $Ba_xSr_{1-x}TiO_3$ where $0 < x < 1$.

10. The capacitor of claim 1, further comprising a substrate assembly on which said capacitor is formed.

11. The capacitor of claim 1, wherein said second electrode includes a strap.

12. A capacitor, comprising:

a first electrode having a non-smooth surface and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

a second electrode; and

a dielectric between said first and second electrodes.

13. The capacitor of claim 12, wherein at least one of said second electrode and said dielectric include a non-smooth surface.

14. The capacitor of claim 12, wherein the non-smooth surface of said first electrode has a hemispherical grain.

15. The capacitor of claim 12, wherein the non-smooth surface of said first electrode has an inverted hemispherical grain.

16. The capacitor of claim 12, wherein said first electrode has a hemispherical grain on one surface and an inverted hemispherical grain on another surface.

17. The capacitor of claim 16, where said first electrode has a hemispherical grain on an inside surface and an inverted hemispherical grain on an outside surface.

18. The capacitor of claim 13, wherein the non-smooth surface of at least one of said second electrode and said dielectric has a hemispherical grain.

19. The capacitor of claim 13, wherein the non-smooth surface of at least one of said second electrode and said dielectric has an inverted hemispherical grain.

20. The capacitor of claim 13, wherein at least one of said second electrode and said dielectric has a hemispherical grain on one surface and an inverted hemispherical grain on another surface.

21. The capacitor of claim 20, wherein at least one of said second electrode and said dielectric has a hemispherical grain on an inside surface and an inverted hemispherical grain on an outside surface.

22. A capacitor, comprising:

a substrate assembly;

a first electrode on said substrate assembly and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

a second electrode; and

a dielectric between said first and second electrodes.

23. The capacitor of claim 22, further comprising an interconnect recessed in said substrate assembly, and wherein said first electrode is formed on said interconnect.

24. The capacitor of claim 22, further comprising a contact recessed in said substrate assembly, and wherein said first electrode is formed on said contact.

25. A capacitor, comprising:

a first substrate layer;

a first electrode on said first substrate layer and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

a second electrode including a strap;

a second substrate layer on said second electrode; and

a dielectric between said first and second electrodes.

26. The capacitor of claim 25, wherein said first substrate layer includes an interconnect connected to said first electrode layer.

27. The capacitor of claim 25, wherein said first substrate layer includes a contact connected to said first electrode layer.

28. The capacitor of claim 25, wherein said second substrate layer includes an interconnect connected to said second electrode layer.

29. The capacitor of claim 28, wherein said interconnect in said second substrate layer is connected to said strap.

30. A device, comprising a capacitor including a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof; a second electrode; and a dielectric between said first and second

electrodes.

31. The device of claim 30, wherein said device is selected from a group consisting of a memory device and a processor.

32. A system, comprising:

a first device including a capacitor including a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof; a second electrode; and a dielectric between said first and second electrodes;

a second device; and

a bus connected to both said first device and said second device.

33. The system of claim 32, wherein said system is a computer system.

34. The system of claim 32, wherein said first device is a memory device and said second device is a memory device.

35. A capacitor, comprising:

a substrate assembly;

an interconnect recessed in said substrate assembly;

a first electrode formed on said interconnect and selected from a group consisting of transition metals, conductive metal-oxides,

alloys thereof, and combinations thereof;

a second electrode; and

a dielectric between said first and second electrodes.

36. A capacitor, comprising:

a first substrate layer;

an interconnect recessed in said first substrate layer;

a first electrode on said interconnect and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

a second electrode;

a second substrate layer on said second electrode; and

a dielectric between said first and second electrodes.

37. The capacitor of claim 36, wherein said first electrode has a non-smooth surface.

38. A method of forming a capacitor including:

forming a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode; and

forming a dielectric between said first and second electrodes.

39. The method of claim 38, wherein forming the first electrode includes performing chemical vapor deposition.

40. The method of claim 38, wherein forming the first electrode includes planarization after performing chemical vapor deposition.

41. The method of claim 38, wherein forming the first electrode from transition metals includes forming the first electrode from a group cosisting of Pt, Rh, Ir, Ru, and Pd.

42. The method claim 38, wherein forming the first electrode from a conductive metal-oxide includes forming the first electrode from a group consisting of IrO_x, RuO_x and RhO_x and wherein $x < 4$.

43. The method of claim 38, wherein forming the first electrode includes forming the first electrode selected from the group consisting of Pt, Rh, Ir, Ru, Pd, IrO_x, RuO_x, RhO_x, wherein $x < 4$, alloys thereof, and combinations thereof.

44. The method of claim 38, wherein forming the first electrode includes forming the first electrode having a non-smooth surface.

45. The method of claim 38, wherein forming the second electrode includes forming the second electrode from a group consisting of transition metals, conductive metal-oxides, aluminum, TiN, TaN, polysilicon, W, and WN.

46. The method of claim 38, wherein forming the second electrode includes forming the second electrode by chemical vapor deposition.

47. The method of claim 38, wherein forming the dielectric includes formed the dielectric from an insulating metal oxide.

48. The method of claim 47, wherein forming the dielectric includes forming a material selected from the group consisting of barium strontium titanate, Ta_2O_5, $SrTiO_3$, $Sr_wBi_xTa_yO_z$, and $Ba_xSr_{1-x}TiO_3$ where $0 < x < 1$.

49. The method of claim 38, further comprising forming a substrate before forming the first electrode.

50. The method of claim 38, wherein forming the second electrode includes forming a strap.

51. The method of claim 37, wherein forming the first electrode includes:

forming a layer of hemispherical grain polysilicon; and

forming the first electrode on the hemispherical grain polysilicon.

52. A method of forming a capacitor, comprising:

forming a layer of hemispherical grain polysilicon;

forming the first electrode on the hemispherical grain polysilicon selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode; and

forming a dielectric between said first and second electrodes.

53. The method of claim 52, further comprising planarizing after forming the first electrode.

54. The method of claim 52, wherein planarizing includes performing mechanical abrasion.

55. The method of claim 54, wherein performing mechanical abrasion includes performing chemical mechanical planarization.

56. The method of claim 52, further comprising removing the hemispherical grain polysilicon.

57. The method of claim 52, further comprising forming a substrate assembly before forming a first electrode.

58. A method, comprising:

forming a substrate assembly;

forming a layer of hemispherical grain polysilicon on the substrate assembly;

forming the first electrode on the hemispherical grain polysilicon selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode;

forming a dielectric between said first and second electrodes;

removing a portion of the substrate assembly; and

removing the hemispherical grain polysilicon.

59. The method of claim 58, further comprising forming an interconnect recessed in the substrate assembly, and wherein forming the first electrode includes forming the first electrode in the interconnect recessed in the substrate assembly.

60. The method of claim 58, further comprising forming a contact in the substrate assembly, and wherein forming the first electrode includes forming the first electrode in the contact.

61. A method, comprising:

forming a substrate assembly;

forming an interconnect recessed in the substrate assembly;

forming the first electrode on the interconnect and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode;

forming a dielectric between said first and second electrodes;

62. The method of claim 61, further comprising forming an interconnect recessed in the substrate assembly, and wherein forming the first electrode includes forming the first electrode in the interconnect recessed in the substrate assembly.

63. The method of claim 61, further comprising forming a contact in the substrate assembly, and wherein forming the first electrode includes forming the first electrode in the contact.

64. A method, comprising:

forming a first electrode having a non-smooth surface and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode; and

forming a dielectric between the first and second electrodes.

65. The method of claim 64, wherein forming the second electrode includes a forming the second electrode with a non-smooth surface.

66. The method of claim 64, wherein forming the dielectric includes a forming the dielectric with a non-smooth surface.

67. A method, comprising:

forming a substrate assembly;

forming a first electrode on the substrate assembly and

selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode; and

forming a dielectric between said first and second electrodes.

68. The method of claim 67, wherein forming the substrate assembly includes:

forming a first layer before forming the first electrode; and

forming a second layer after forming the second electrode.

69. A method, comprising:

forming a first substrate layer;

forming a first electrode on the first substrate layer and selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof;

forming a second electrode including a strap;

forming a second substrate layer on the second electrode; and

forming a dielectric between said first and second electrodes.

70. The method of claim 69, wherein forming the dielectric is performed before forming the second electrode.

71. The method of claim 69, wherein forming the first substrate layer includes forming an interconnect connected to the first electrode layer.

72. The method of claim 69, wherein forming the second substrate layer includes forming an interconnect connected to the second electrode layer.

73. The method of claim 72, wherein forming the interconnect in the second substrate layer includes forming the interconnect connected to the strap.

74. The method of claim 69, wherein forming the second substrate layer includes forming a contact connected to the second electrode layer.

75. The method of claim 69, wherein forming the contact includes forming the contact connected to the strap.

76. A method of forming a device, comprising forming a capacitor including forming a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof; forming a second electrode; and forming a dielectric between the first and second electrodes.

77. The method of claim 76, wherein forming the device includes forming the device selected from a group consisting of a memory device and a processor.

78. A method of forming a system, comprising:

providing a first device including forming a capacitor including forming a first electrode selected from a group consisting of transition metals, conductive metal-oxides, alloys thereof, and combinations thereof; forming a second electrode; and forming a dielectric between the first and second electrodes;

providing a second device; and

providing a bus connected to both the first device and the second device.

79. The method of claim 78, wherein forming the system includes forming a computer system.

80. The method of claim 78, wherein forming the first device includes forming a memory device and forming the second device includes forming a memory device.